

MICROPOLIS BASIC 4.0 VARIABLE AND ARRAY STORAGE LOCATION

by Keith B. MacAdam

350 Blueberry Road, Lexington KY 40506

Tel. (606) 257-3344 (work), 277-1993 (home)

It might be useful to users of Micropolis BASIC 4.0 to know how and where BASIC stores variables, so that direct access to them can be had by assembly-language routines called from BASIC. I investigated this recently while writing routines to support a transient digitizer (Rev. Sci. Instrum. 52, 297 (1981)) and its oscilloscope display in my atomic physics laboratory. What follows is a description of the vector table, contained within the BASIC interpreter, that points to the storage locations for BASIC variables and arrays. Although the storage locations will change as a program is modified, the locations of the vectors remain fixed. Therefore assembly-language routines can look at the fixed vector locations and thus remain valid for different versions of a BASIC program. All vectors are stored in low-high format, that is, a hexadecimal memory address ABCDh will be found stored as CD AB in a memory dump. The first, or lower-address, location (containing the lower-order byte) will be given below as the vector locations.

VECTOR TABLE

331B	Vector to the first byte following the table	
331D	Vector to assembly-language function FAA	
331F	" " " " " "	FAB
33nn	" " " " " "	FAn
334F	" " " " " "	FAZ
3351	Vector to BASIC user-defined function FNA	
33nn	" " " " " "	FNn
3383	" " " " " "	FNZ
3385-33B8	Vectors to real arrays A(),...,Z().	(26x2 bytes)
33B9-33EC	Vectors to string arrays A\$(),...,Z\$().	(26x2 bytes)
33ED-3420	Vectors to integer arrays A%(),...,Z%().	(26x2 bytes)
3421	Vector to the start of the A0,...,Z0 alphabet	
3423	" " " " " " A1,...,Z1	"
34nn	" " " " " " An,...,Zn	"
3433	" " " " " " A9,...,Z9	"
3435	" " " " " " A,...,Z	"
3437-346A	Vectors to strings A\$,...,Z\$.	(26x2 bytes)
346B	Vector to the start of the A%,...,Z% alphabet	
346D-3480	Space for ten more vectors	(unknown)
3481	First byte after the vector table (pointed to by 331B)	

MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER #68 - MARCH 1986

Further, it is useful to know how various quantities are stored at the locations pointed to by the vectors. Details are given in the Micropolis PDS 4.0 binder, pp. 5-10 to 5-12, except for headers that precede arrays. For instance, the vector at 33EDh points to the first byte of a four-byte header that precedes A\$(0). An array established by a dimension statement DIM A\$(191) is stored as follows:

```
01    C0    00    03    /    n    n    n    m    m    m    (etc.)
#dim  (--#els-- ) ISIZE /    (---A$(0)---) (---A$(1)---)
```

where:

#dim is the number of dimensions of the array, here one.

#els is the total number of array elements, in low-high format, here 192.

ISIZE is the SIZES parameter that specifies how many bytes are used for storage of each integer quantity.

The array elements follow in groups of ISIZE bytes each with no separation.

A string array dimensioned by DIM A\$(255,10) is pointed to by the two-byte vector at 33B9h. The array is stored as follows:

```
01    00    01    0C    /    0A 05 48 45 4C 4F 00 00 00 00
#dim  (--#els-- ) SIZE /    max curr ("HELLO  ")
```

where:

#dim and #els have same meanings as above.

size specifies the number of bytes storage used per string element (#bytes data+2, here 12). size overrides SSIZE in the SIZES statement.

max is the maximum number of characters reserved for each string-array element (here 10).

curr is the current length of that individual string (here 5).

The next ten (=max) bytes contain the hex representations of the first array element, here A\$(0)="HELLO", left-justified in the field. Element A\$(1) follows immediately, beginning with the two-byte sub-header, (max) and (curr), and ten bytes data.

Variables that are assigned as a whole alphabet at once (i.e., A-Z, A0-Z0, ..., A9-Z9, A%-Z%, and A\$-Z\$) are stored in a compact format without any header. For instance, when RSIZE=5, a real alphabet A-Z occupies 1 byte (sign and exponent) + 4 bytes (BCD data) = 5 bytes per variable. The entire alphabet thus occupies $5 \times 26 = 130$ bytes in memory. The vector at 3435h points to the first byte of the five reserved for A. The 130 bytes are reserved regardless of whether any other variables in that alphabet are used. If no variable in an alphabet is used, no 130-byte block is allocated, and the vector for that alphabet is null. If an array is neither DIM'ed nor used, no vector is established for it. No vectors are established for un-DEF'ed BASIC or assembly-language functions.

As stated on page 5-25 of the PDS 4.0 binder, the SIZES parameters RSIZE, ISIZE, and SSIZE, are stored at locations 04C5h, 04C6h and 04C7h, respectively.

Using this information, a machine-language program can find the storage location of any variable or array element in memory by reading the SIZES parameters, reading the appropriate vectors from the table, calculating an offset past any array header and into any array element or into any alphabet of variables. There is no limit (such as NARG <= 4) on the number of arguments passed to an assembly-language program or on the number of results returned.

Other users should verify that the exact vector locations are as I have stated above in case there are discrepancies between different issues of Micropolis BASIC 4.0. This can be done by running a program such as the following.

```

10 DIM A(2),B(2,2),C(2,2,2),Z(2,2,2,2)
20 DIM A%(2),B%(2,2),C%(2,2,2),Z%(2,2,2,2)
30 DIM A$(2,10),B$(2,2,10),Z$(2,2,2,10)
40 A=111:Z=999
50 A$="ASTRING":Z$="ZSTRING"
60 A%=1111:Z%=9999
70 A0=1.0:Z0=26.0
80 A1=1.1:Z1=26.1
90 A2=1.2:Z2=26.2
100 A3=1.3:Z3=26.3
    (etc.)
110 DEF FAA=16R5010:DEF FAZ=16R5260
    
```

If the computer has a resident monitor, such as Zapple, press RESET after executing the program, dump the memory block 3300h-3500h and locate the vector table structured as above. Then dump the memory areas to see that the variables and arrays you have put numbers into have been stored as expected.

Since MDOS is smaller than BASIC, you can also LINK "MDOS" from BASIC without spoiling the vector table and use DUMP and ASSIGN 2 3 to obtain hard copy.

Since I'll be using Micropolis BASIC as long as I can keep my Micropolis hardware running, I'd appreciate hearing (or seeing in the Micropolis/Vector Graphic Users Group Newsletter) any other useful and little-known facts that others have discovered. I hope the above notes are helpful.

.....

MICROCOMPUTING IN INDIA

by A.C. Lynn Zelmer
 International Communications Institute
 Box 8268, Station F, EDMONTON, AB T6H 4P1 Canada

To an observer in North America it certainly seems like computers are here to stay. Some observers would even say that we are in the beginning stages of the promised "wired world". Certainly no one would deny that computers, and especially microcomputers, form an integral part of our working world.

MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER #68 - MARCH 1986

My work sometimes takes me overseas. I thought that the readers of the MUG newsletter might be interested in some information about the state of computerization in another country. This comparison might give us a basis for evaluating our own developments and perhaps an understanding of the problems faced elsewhere.

India is a large country with a population somewhere just under one billion. It is one of the most technically advanced of the so-called Third World countries. However it is also a country of extreme contrasts: industrial developments and space technology exist side-by-side with bullock carts and hand agricultural techniques.

DATAQUEST, an Indian monthly magazine, reported in August of 1985 on a recent survey of Indian computer sales. This survey points out the difficulties of ever achieving the "wired world" dream.

DATAQUEST defines home or personal computers as 8 bit machines produced within India which sell for less than 30,000 rupees. Microcomputers are 8 or 16 bit machines which are used in business offices and sell for less than 300,000 rupees. Mini computers comprise all the rest. For comparison purposes, one U.S. dollar roughly equals 7.5 rupees and the annual salary of a well-paid civil servant or business worker might not exceed 50,000 rupees.

As can be seen in the table below, the home or personal installations increased by over 400% between 1984 and 1985. The micro market increased by 116%. This however represents a total installed base of only 4350 machines in both the personal and business markets. In addition, the home or personal market really represents the education market. Most of the small machines are purchased for school use. 95% of Indian families cannot afford to even think of purchasing a home computer.

	1984	1985
	----	----
Home/personal	300	1750
Microcomputer	1200	2600
Mini computer	300	550

Total Installations in India 1984/85

At the beginning of the year, the typical micro was 8 bit, 64K of RAM with two floppy drives, a printer and ran CP/M. The end of the year saw more 16 bit machines, typically 128K with either two floppies or one floppy and a hard disk, a printer and ran MS-DOS. The 16 bit revolution hasn't really hit India as of the middle of 1985, however it should be noted that import duties probably exceed 200% for imported PC-type machines. While the 8 bit market included a large number of indigenous producers (each of whom sell a few hundred machines), the 16 bit market looks more like collaboration with foreign firms to assemble PC-clones within India.

November 1984 saw a major change in Indian government policies regarding computers and was supposed to stabilize the indigenous market. I don't pretend to understand either the old or the new policies, however the confusion continues to exist within the market place. High import duties accompany machines with less than 1 Mb of main memory and 300 Mb of disk storage. In fact, it is possible to import a multi-user mini with this type of memory/disk configuration for slightly more than a single-user PC-clone with 20 Mb of hard disk storage. The lack of price stability has also created concerns: a PC compatible which cost almost 450,000 rupees in 1983 cost less than 100,000 rupees in 1985. We here in North America are familiar with similar price reductions, however in India these kinds of reductions represent the equivalent of more than a year's salary for an employee. It is no wonder that the market is slow.

Training in computer literacy is very definitely a growth area in India, as elsewhere in Asia. A typical training establishment funded by public funds or in a non-profit agency would have one or two Apple-II or Commodore 64 type computers in a small classroom seating up to 20 students. A two week program might allow the student to have one to two hours of hands-on practice with BASIC programming or applications programs. Private (profit-making) institutions might have twice the students and fewer computers. As in North America, the standards for training are non-existent and many students receive a marginal program.

I would hate for anyone to think that all was bad. The Indian market place is producing a large number of computer programmers and computer applications specialists. The Indian manufacturers are producing machines within India, albeit with mostly all imported components. There is a high level of commitment within education and government to the development of computer literacy programs and to the use of computers. However, it is a very different situation from the one that we are familiar with, and I am afraid that the gap between our situation and theirs is widening day by day.

.....

PROGRAMMING TIPS - Keyboard to Disk Transfers

by Steve Brandli
of Al Brandli and Associates
3176 Pullman, Suite 103, Costa Mesa CA 92626 - (714) 754-6363
(reprinted from the ABA Bulletin)

As a programmer at ABA I've been asked to relay to you some tips each month that just might make your computing chores a little easier and maybe even more enjoyable. If you have any questions or subject areas you would like me to address in this column, don't hesitate to get a message to me. I would like to know your interests.

This month I'd like to show you a trick for creating an ASCII text file without having to use (and more importantly, learn) a text editor (like SCoPe) or word processor (like Memorite). Most of you know that PIP is a utility used to copy

MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER #68 - MARCH 1986

one file to another. But did you know that you can use PIP to copy from one device to another?

PIP recognizes the symbol CON: to mean the console device. And if you tell PIP to transfer text from the CON: device to a file,

```
A>PIP FILENAME.EXT=CON: (cr)
```

it will assume you mean read the keyboard and transfer what is typed to the file (FILENAME.EXT in this case). PIP will transfer what you type until you enter an End Of File (EOF) character which is a Control-Z (cntl-Z).

Before I give you an example, let me give you two hints about this method. First, PIP will transfer EVERY character you press into the file. If you type a backspace to correct a mistake, PIP will copy the mistake, the backspace, and the correction into the file. This is not acceptable in most cases. Second, most applications expect a Carriage Return (cr) and Line Feed (lf) at the end of each line. To get these characters into the file, press both keys at the end of each line you type.

A good application (one that I use very often) for this shortcut is the SUBMIT utility (batch processor). You can create quick submit files using PIP as described above. For instance, the following will create a submit file that, when the command SUBMIT START is typed, will configure the printer on Extended CP/M systems and then run Memorate.

```
A>PIP START.SUB=CON:(cr)
CONFIG 1 (cr) (lf)
MEMORITE (cr) (lf)
cntl-Z
```

Remember, make a mistake and you must start over! A cntl-Z will stop the PIP command.

Try it and see what happens.

.....

DAMAN'S SOFTWARE CLEARANCE

For the last few months, I've been running ads about software that DAMAN has in inventory that we're trying to move. I've had some questions on just what this software does. Seems like a reasonable request, so here's a discussion of one of these items.

CACHE/Q - A Utility For CP/M 2.2

Cache/Q lists for \$225, in the 8-inch format. DAMAN currently has one copy that we'll sell for \$135 in either 8-inch or Micropolis/Vector Graphic format. Any additional purchases would retail for \$185 for the 8-inch format, or \$195 for Micropolis/Vector Graphic. I really thought Cache/Q was a nifty idea, but

I never tested it. Therefore I don't know whether it works on any particular system, though, since the product has been on the market for several years, I'm pretty sure that it generally works.

Cache/Q is a software product; a disk buffering enhancement for the CP/M 2.2 operating system. Cache/Q uses some of the memory in your computer to buffer sectors of data from your disk drives. It is the generic equivalent to (actually seems quite superior to) Vector's Extended CP/M. This can dramatically speed up the execution of your programs since, if a requested sector of data is in a Cache/Q memory buffer, your computer will not have to spend a lot of time getting the data from the disk. Accompanying literature speaks of disk accesses taking something like 350 milliseconds while Cache/Q takes 1.3 milliseconds.

Cache/Q also incorporates a background print buffering capability. This feature allows your programs to "print" at up to 4000 characters per second. Depending on the size of the Cache/Q buffer space and the printer speed, up to 30 minutes of printing can be overlapped with normal system usage. An additional feature is that it is designed to work with computers connected to two or more printers. As long as printer output is directed to the appropriate printer using the IOBYTE mechanism, all existing programs will work correctly with no modifications.

If your computer has a single bank of 48K or more of memory, Cache/Q operates in the Single-Bank Mode. Both the Cache/Q code and the buffer space must come out of your main memory space.

However, many computers are equipped with, or may be expanded to contain, extra memory in the form of "bank select" memory. In a computer equipped with bank select memory, Cache/Q may be operated in the Multi-Bank Mode and only a small part of the Cache/Q program is located in the main bank of memory. The remainder of the Cache/Q program, and all of the sector buffers, are located in the extra memory banks. Cache/Q supports up to 32 extra memory banks. That's a lot of potential buffer space.

.....

MDOS AND OSM SOURCE CODE AVAILABLE

Micropolis has decided to release the source code for their MDOS and OSM operating systems.

The Micropolis Disk Operating System (MDOS) requires a Micropolis 1071 controller, which in turn requires 16-hard-sector disks. The current MDOS source code supports 35 and 77 tracks, single or double sided, formats. I don't know of any particular reason why one couldn't change the code to support a 40 and 80 track format. The controller expects the drive interface to be, of course, a Micropolis 1015. If you understand what signals are on the data cable, I'd expect you could interface the software and 1071 controller to any device.

MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER #68 - MARCH 1986

Purchase of the MDOS source code would allow you to:

1. understand how your current MDOS executable code works;
2. modify routines to better suit your particular requirements; and,
3. attempt adaptation to drives other than Micropolis.

The MDOS source code comes on three disks and supports the modules of MDOS, RES, BASIC, DISKCOPY, ASSM, DEBUG, COPYFILE, FILECOPY, CONFIG, GEN-BUG, FEATURES, and LINEEDIT.

The Operating System/Micropolis (OSM) source code expects an MDOS-based system (1071 controller and 1015 drive) interfacing to a Micropolis 1200 series, 8-inch, hard disk through an S-100 Micropolis Intelligent Data Adapter (IDA) board. This is a great system, being multi-user, multi-tasking, with built-in binary-tree key access.

There are 14 disks of source code, more than enough to hold your interest for a month or two.

For an education on how operating systems work, and on assembly language programming, these products fit the bill. The code is self-documented. There is no additional documentation available.

You can purchase this source code from DAMAN. Prices are:

MDOS Source Code	\$100
OSM Source Code	\$200
.....	

BRANDLI INVENTORY CLEARANCE

Al Brandli and Associates is also cleaning house. Listed below are selected items from his flyer. Contact Al at (714) 754-6363, or write him at 3176 Pullman, Suite 103, Costa Mesa CA 92626.

Used single-user floppy-based systems: Vector System B or MZ Computer with 64K and 300K drives, \$995. Vector 2600 Computer with 64K and 2 630K drives, \$1695.

Used single-user hard-disk-based systems: Vector 3005 Computer with 64K, 1 630K floppy, 1 5Mb hard disk, \$1,895. Vector 3010 Computer with 64K, one floppy and a 10Mb hard disk, \$2,195.

Used single-user Vector 4 Computers with 128K and CP/M-86: 4/20 with 2 630K drives, \$1,495. 4/30 with 5Mb hard drive, \$1,695. 4/40 with 10Mb hard drive, \$1,995.

Used multi-user (up to four add-on terminals) hard-disk-based systems: Vector 5005 Computer with 128K, one floppy and a 5Mb hard disk, \$1895. Vector 5010 Computer with 128K, one floppy and 10 Mb hard disk, \$2,295. Vector 5032 Computer with 64K, one floppy and a 32Mb hard disk, \$2,295. Vector 5032E Computer with 128K, one floppy and a 32Mb hard disk, \$2,995. Extra terminals, \$695.

CLASSIFIED

The Classified Section of the MUG Newsletter is available to all users, free of charge. Just call or write us with a description of what hardware, software, information, etc., that you want to obtain, or dispose of.

.....

FOR SALE - Vector Graphic MZ system plus Micropolis 1053-2 external storage module (total four drives). Beautiful condition. Manuals, software, cables, included. \$399 for everything - I'll pay the shipping cost. Write or call for detailed list and photo.

Sheldon Gates, Box 15547, Phoenix AZ 85060. Phone (602) 840-4943.

.....

FOR SALE - Vector Graphic-3 boards: 6-slot mother board, Flashwriter II, 64K RAM, ZCB (6 MHZ), and evidently non-working FD controller, all for \$300. Also two Tandon 100 TPI DSDD drives, one with an odd mechanical problem, other fine. Dysan 100-TPI alignment disk included, all for \$175. Approximately 50 16-hard-sector diskettes, some never used, including Peachtree 4 accounting package, Memorate, Execuplan, and a variety of Vector CPMs, all for \$75.

Richard S. Adcock, 913 Sharondale, Ft. Worth TX 76115. Phone (817) 923-4264.

.....

FOR SALE - Vector System 3 with Tandon drives (1.2 Mbyte on 2 floppies), lots of software, shipped UPS for \$875.

Software included with the above System 3 is: Memorate III, Execuplan II, Accuchart, Peachtree General Ledger/Accounts Receivable/Accounts Payable/ and Inventory, Vector Datamanager. The software packages have complete documentation.

This system has been used no more than 150 hours and is in superb condition. If you can use the software, the purchase price can be justified for that alone.

Also have Vector MZ with SOROC 120 commercial terminal with extra (3rd) Micropolis MOD II floppy and MDOS software, shipped UPS for \$450. The software is a General Ledger package, Data Management, and the Micropolis MOD II Diagnostics (program) Disk.

Darsey, P.O. Box 279, Cape Coral FL 33910-0279. Phone (813) 542-8557.

.....

FOR SALE - Vector System B, \$400 or best offer. Also, brand new (surplus) Vector MP dot matrix printer, \$100.

Doug McGinnis, 3850 Crescent Dr., Santa Barbara CA 93110. Phone (805) 569-0898 or (805) 963-4450.

.....

MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER #68 - MARCH 1986

CLASSIFIED (continued)

FOR SALE - Micropolis 1053 dual-drive sub-system (MOD II), complete with MDOS and Micropolis Basic; a supply of about 60 16-sector diskettes, some new, some slightly used; and a Micropolis drive maintenance manual. Did not sell the above lot at a previously advertised price of \$500. If you're looking for a 1053 in excellent condition, call or write and negotiate a reasonable price for any or all of the above items.

Louis E. Wheeler, 1323 Tamera Drive, Oceano CA 93445. Phone (805) 481-5687.

* MICROPOLIS/VECTOR GRAPHIC USERS GROUP NEWSLETTER *
* Published Monthly by DAMAN, 604 Springwood Circle, Huntsville AL 35803-1740 *
* Subscription rates: North America; \$18/year Elsewhere; \$25/year, Airmailed *
* *
* For Assistance with general information, MUG/Vector Graphic, DAMAN hardware *
* & software, Micropolis Basic, Basic/z, Micropolis drives & Micropolis parts-*
* *
* Call Lynn at (205)881-1697 during the Central Times of 9 AM to 5 PM. Buzz *
* is sometimes around in the evening (Lynn will know) and from 9 - 12 on Sat. *

MICROPOLIS/VECTOR GRAPHIC
USERS GROUP
A Division of DAMAN
604 Springwood Circle
Huntsville AL 35803-1740
(205) 881-1697



FIRST CLASS MAIL
=====

FIRST CLASS MAIL
=====

POSTMASTER: RETURN ADDRESS CORRECTION REQUESTED